

PORGANS 325 USFWS report on EWA 2007

Environmental Water Account Expenditures for the Protection of the Delta Smelt in Water Year 2007

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Introduction

The purpose of this document is to summarize the expenditure of Environmental Water Account (EWA) assets for the protection of the federally-listed delta smelt (*Hypomesus transpacificus*) and the activities of the Delta Smelt Working Group (Working Group). Because this is the seventh in a series of reports written with the same general purpose and audience in mind, significant background information has been omitted and some prior knowledge of the operation of the State Water Project, Central Valley Project and the EWA is assumed. Previous years' reports may be found on the California Bay-Delta Authority Science website.

During the seven years of EWA implementation, the use of EWA assets has undergone a strategic shift, reflecting changes in the understanding of species biology and of the ecological and physical processes operating in the Sacramento-San Joaquin Delta (Delta). Use of assets for delta smelt focuses on State Water Project (SWP) and Central Valley Project (CVP) Delta export curtailments timed to protect spawning and pre-spawning adults and/or to promote young-of-the-year emigration from the Delta to Suisun Bay. Use of EWA for delta smelt is driven less by salvage at the export facilities and more by real-time assessment of overall trends in delta smelt abundance and distribution, reproductive potential and other relevant factors, using a decision process described in the 2005 Biological Opinion for the Operations Criteria and Plan (OCAP) (Service 2005). This real-time assessment is intended to generate, if needed, science-based recommendations for modifications to Project operations to avoid delta smelt entrainment events leading to elevated salvage.

Delta Smelt Status

The delta smelt was listed as a threatened species effective April 5, 1993 by the U.S. Fish and Wildlife Service (Service) under the Endangered Species Act (ESA) of 1973, as amended. On March 31, 2004 the Service completed a five-year status review for the delta smelt as a partial settlement for two lawsuits (Service 2004). The review concluded that the delta smelt population remains relatively low,

compared to historical levels, and that many of the threats to the species identified at the time of listing still exist, precluding de-listing of the species. Since that time, the 2005 Fall Mid-Water Trawl (FMWT) survey performed by the California Department of Fish and Game (CDFG) resulted in an index of 24 for delta smelt, the lowest ever recorded, while the 2006 index was 41, the second lowest ever recorded (Table 1, Figure 1). Recently, CDFG's 2006 and 2007 Summer Tow-Net surveys generated an index value of 0.4 for delta smelt (Table 1), not substantially different from the 2005 record low of 0.3.

The 2005 Recovery Index was 4, the lowest index ever recorded and well below the 2003 index of 101 (Table 1) and the target abundance criterion of 239² specified in the Recovery Plan (Service 1996). The 2006 Recovery Index was 21. Following the criteria specified in the Service's 2005 biological opinion on OCAP (Service 2005), the "concern level" for salvage of adult delta smelt for water year (WY) 2006 was set at 143. The concern level for adult delta smelt salvage was not exceeded in WY 2007. The total salvage of delta smelt at the State and Federal export facilities was 2705 in WY 2007 (36 adults, 2669 juveniles). Since the implementation of the EWA, salvage for December through June has ranged from 336 in WY 2006 to 66,526 in WY 2002 (Table 4, Figure 2).

On July 6, 2006, the Bureau of Reclamation requested reinitiation of formal consultation on OCAP, citing changed circumstances, specifically the apparent recent dramatic decline in abundance of pelagic organisms. Reconsultation on OCAP is anticipated to be completed by September 2008. The 2005 Biological Opinion remains in effect during consultation.

Delta Smelt Working Group

Because of the high level of concern for delta smelt in WY 2007, the Working Group conferred frequently throughout the year. Briefing documents and meeting notes are available on the Sacramento Fish and Wildlife Office's website at http://www.fws.gov/sacramento/es/delta_smelt.htm. The Working Group's purpose and charge are described in the Service's 2005 Biological Opinion on OCAP (Service 2005). A summary of the Working Group's activities is included as part of the narratives in later sections of this report.

Environmental Conditions

Based on December forecasts, WY2007 was forecasted to be a dry year. Precipitation from October through January was about 55% of average for the

¹ The median of delta smelt fall mid-water trawl indices in pre-decline years

state (Department of Water Resources [DWR] 2006b). January 2007 was the driest since the drought year 1991, at about 20% of average. Statewide precipitation for WY2007 was 66% of average (DWR 2007a). Water storage (mostly carryover from WY2006) was approximately 110% of average in February. Friant and Folsom reservoirs reported just below half of their total capacities at the end of December, while New Melones, Oroville, San Luis, Shasta, and Trinity reservoirs all reported more than 70% of their total capacity by the end of December.

In October of 2006, the National Weather Service reported that ocean conditions had begun to exhibit a typical El Niño pattern, a period of warmer conditions in the tropical Pacific through the Northern Hemisphere winter, typically resulting in less than average rainfall and warmer than average temperatures in the western United States (NOAA 2006). By February, the National Weather Service was reporting that the El Niño pattern was decreasing and that El Niño Southern Oscillation (ENSO)-neutral conditions were likely to develop through March-May. In April, the National Weather Service reported that La Niña conditions were beginning to strengthen. However, La Niña conditions weakened in June, leaving ENSO-neutral conditions in the western U.S. in July.

Runoff was forecasted to remain below average through July, and the SWP and CVP predicted that the Delta would remain in balanced conditions through the summer (DWR 2007a), mostly due to the carryover water storage in central valley reservoirs.

2006 CALFED Science Conference

Two scientific findings in the fall of 2006 were provisionally recognized by the WOMT during January 2007. First, Dr. William Bennett (UCD) presented his "Big Momma Hypothesis" at the 2006 CALFED Science Conference. This theory suggested not all smelt are created equal. Large adult females produce more eggs and their offspring tend to survive better, making them potentially more important in setting later abundance indices than had been previously thought.

The second scientific finding with significant management implications was put forward by Dr. Pete Smith (USGS) at the 2006 CALFED Science Conference. Smith observed a relationship between the magnitude of upstream flows in Old and Middle Rivers (OMR) in January and February and the number of adult smelt seen at the SWP and CVP fish salvage facilities. He concluded that greater flows upstream carried more smelt to the pumps which removed them from the population before they could reproduce or left them in a location where their progeny would be highly susceptible to entrainment.

The management implications of these two findings resulted in a more focused effort on the early part of the delta smelt season and the earlier consideration of minimization of negative OMR flows.

Expenditure of Environmental Water Account Assets/Delta Smelt Situation in WY 2007

During its seven years of implementation, the EWA has used an average of 285,000 acre-feet (285 TAF) of water assets annually. Asset expenditures varied with Delta hydrology, the level of concern, and the immediate situation as indicated by real-time monitoring of delta smelt abundance and distribution evaluated using established decision processes.

The Delta Smelt Risk Assessment Matrix (DSRAM) is the decision process formulated by the Working Group, building on an earlier decision process and incorporating more recent science, to better reflect the process used by the Data Assessment Team in evaluating real-time monitoring data. The DSRAM is also described in the Service's OCAP biological opinion (Service 2005).

For planning purposes, fish actions were assumed to be relatively less costly in terms of environmental water assets in drier years, as the amount of water required to reduce exports from the baseline level to a more protective level is less than in wetter years. However, in WY 2007, a drier year, the EWA used approximately 500 TAF of assets, with multiple fish actions specifically recommended for the protection of delta smelt (Table 2). This compares with 290 TAF in 2001, 248 TAF in 2002 and 124 TAF in 2004, all drier years, and with 346 TAF in 2003, 339 TAF in 2005, and 149 TAF in 2006, which were wetter years (Table 3; Figures 6 and 7). The EWA has tended to expend more assets on average in May than in other months (Figure 6), as assets have been used to support the Vernalis Adaptive Management Plan (VAMP) export curtailment annually and a post-VAMP shoulder in most years.

Actions to Protect Pre-Spawning Delta Smelt

Due to the very low abundance of delta smelt as indicated by the FMWT survey, it was the first priority of the Working Group to minimize the entrainment of pre-spawning adults. Analyses completed for the 2004 OCAP Biological Assessment indicated that by the time a salvage event becomes apparent, it would likely be too late to provide significant protection. The Working Group believed that it would be prudent to implement a protective action in winter as a precautionary measure, in advance of receiving information from surveys or salvage. Recognizing that environmental water assets would be limited, the Working Group decided to identify a mid-winter action that would not only be

protective of adults, but also minimize or avoid the need for spring actions to protect larvae and juveniles.

On October 10, 2006, the Working Group made a preliminary recommendation to implement a proactive winter action to address concerns about wintertime entrainment of adults during “first flush” conditions. The Working Group thought that no action would be needed until after December 25 and after Delta water temperatures dropped below 13⁰ C. Once Delta conditions were suitable for spawning movement and Sacramento River flows at Freeport were above 25,000 cubic feet per second (cfs), operational changes at the state and federal facilities in the south Delta would be needed to maintain flows in OMR at no more negative than -3,500cfs. If no Sacramento River pulse above 25,000 cfs occurs by January 15th then OMR flows should be moderated to a range of -5,000 cfs to -3,500 cfs until February 15th. The Working Group believed this would minimize entrainment of pre-spawning delta smelt. This recommendation was formalized on December 11 and presented to the Water Operations Management Team (WOMT) on December 19. WOMT finalized the recommendation, but made several modifications to the OMR flow criterion to accommodate data acquisition and project operations scheduling.

At the October 10, 2006 meeting the Working Group also identified a need for additional runs of DWR’s Particle Tracking Modeling (PTM) of the effects of Clifton Court Forebay (CCF) intake gate operations. Review of the results revealed that “barriers out” compared to “barriers in” made a much greater difference in particle fates than did CCF gate operations. Differences in other operating scenarios indicated that low flows and low exports would be preferable to higher flows and higher exports.

On December 11, 2006, the Working Group made a recommendation to forego installation of the spring Head-of-Old River Barrier (HORB) and to postpone installation and operation of the agricultural barriers until June 1. On January 11, DWR presented refinement of the PTM runs without the installation of the HORB and with the agricultural barriers installed, showing similar results as when none of the barriers are installed. Consequently, the recommendation regarding the agricultural barriers was rescinded by the Working Group.

Adult Delta Smelt EWA Action #1: On January 9, the fishery agencies recommended to WOMT that the Projects target a five-day average measured OMR flow of -4,000 cfs. The WOMT agencies agreed to this target for January 15 through February 15 (DWR 2007b). On January 15, SWP reduced its pumping to 2,500 cfs to achieve the OMR flow target of -4,000cfs as set by WOMT. This action continued until March 6.

In early February, the Working Group reported that since no salvage had occurred and the CDFG Spring Kodiak Trawl (SKT) had not collected delta smelt in the central or southern Delta (Figure 3a), that it was likely delta smelt were not present in the south Delta. The delta smelt collected were mostly in pre-spawning stage, although five males had mature gonads.

The Working Group recommended in early February to continue moderating OMR combined flow to a range of -5,000cfs to -3,500cfs after February 15. Given the results of the SKT to date, and increasing trends in water temperatures, the Working Group concluded that spawning was imminent, and that therefore, continuing the OMR flow target past February 15 would support the goal of avoiding adult delta smelt entrainment.

In late February, the Working Group believed that some adult smelt had moved into the central and south Delta, due to the 36 salvaged delta smelt and other incidental observances in the south Delta. The Working Group also discussed potential spring actions based on the result of the PTM runs completed to date, what was known of delta smelt distribution in the Delta at the time, the presence of mature female delta smelt (stage 4), and expected increase in water temperatures. The Working Group agreed that a likely spring recommendation to the WOMT would include keeping OMR flows between -4,000 and 0 cfs.

Adult Delta Smelt EWA Action #2: On March 6, after considering the very low adult delta smelt salvage, the northwestern adult delta smelt distribution and the EWA water costs associated with this action (4-6 TAF per day), WOMT decided to change the target flow for OMR to a five-day average of about -5,000 cfs for the next week. This action continued until late March.

Review of a new analysis by DWR at the March 12 Working Group meeting showed that the relationship between OMR flows and salvage also applies to other pelagic fish species. The relationship holds for winter (adult fish) as well as spring (larvae/juveniles) salvage. The consistency of this relationship across species suggests that variation in OMR flows causes the observed variation in salvage. The Working Group believed that these results further support moderating OMR flows as an action to protect delta smelt. Further, analysis of the relationship between OMR flows and salvage showed that an OMR flow of negative 5,000 cfs may be at the threshold where salvage is still minimized. The change in operations to target OMR flows of -5,000 cfs may therefore still provide necessary protection for delta smelt. The Working Group therefore agreed that there was no need to recommend any changes to SWP's operations.

The distribution of pre-spawning delta smelt centered around the confluence and the Sacramento River Deep Water Ship Channel (DWSC) (Figures 3a and 3b) for

most of the winter. However, due to very low apparent abundance, the concern for adult delta smelt remained high through the winter. For WY 2007 the Concern Level (the cumulative total of pre-spawning adults salvaged by the SWP and CVP between December 1 and March 31), which is calculated from the Recovery Index, was not reached, as the entrainment levels were very low. The Concern Level in WY2006 was 143, WY 2005 was 892, and in WY 2004 would have been 3,605, if the current Biological Opinion had been in effect. Adult salvage at the CVP concluded on February 25 with a total of 36 adult delta smelt. No adult delta smelt were salvaged at the SWP.

Actions to Protect Young-of-the-Year Delta Smelt

Adult delta smelt appeared to be maturing somewhat later than what has been observed in the past. The Working Group continued to monitor Delta conditions and survey data for indications that spawning had begun. Due to fish condition and Delta water temperatures in mid-March, the Working Group again believed that the onset of spawning was imminent (conditions had appeared imminent since mid-February).

In March, the Working Group discussed concerns that larval entrainment could increase with the projected OMR flow levels. The Working Group believed the majority of spawning would occur in the lower Sacramento River. The group felt that any recommendation to WOMT should be concentrated on protecting larvae originating from Cache Slough, DWSC, and the Sacramento River downstream of the DWSC. On March 12, the Working Group discussed a potential recommendation to WOMT to protect delta smelt larvae originating in the Sacramento River portion of the Delta that would include keeping OMR between -5,000 cfs and -2,000 cfs.

In late March, the SWP and CVP facilities were being operated to achieve compliance with water quality objectives (SWRCB D-1641), so the EWA daily cost to reduce pumping went to zero. Compliance with water quality objectives kept OMR flows less than -2,000cfs from mid-April through mid-May.

At the March 27 meeting, the WOMT requested that the Working Group develop criteria for the opening of the HORB in the event young of the year delta smelt distribution shifts to the south Delta during implementation of the VAMP. However, because of the projected hydrology during VAMP, time of year, estimated delta smelt distribution, and the observations of delta smelt spawning; the Working Group believed it was unlikely that conditions would be such that opening of the barrier during VAMP would provide additional protection to delta smelt larvae and juveniles. Therefore, the Working Group did not see a need to develop criteria for opening of the barriers during VAMP.

Due to continued concerns, in early April, the Working Group recommended keeping OMR combined 5-day average flows no more negative than -5,000 cfs to minimize diversion of delta smelt larvae into the Central Delta and to the water export facilities.

DWR began in-water work for installation of the Head of Old River Barrier on April 17. The barrier was closed on April 20.

The combination of low numbers of adult delta smelt seen in the SKT and the record low number of larvae sampled in the 20-mm survey through early May suggested that there was a high likelihood of very low recruitment of adults. Further, water temperatures in the Delta had risen above the range wherein the majority of delta smelt spawning occurs, meaning that very little additional spawning was likely to take place. For an annual species such as delta smelt, failure to recruit a new year-class is an urgent indicator that the species has become critically imperiled and an emergency response is warranted. Based on these considerations, and in addition to 1) low population numbers in previous years 2) current distribution of the population and 3) current entrainment rates, the Working Group concluded that it was of the utmost importance to avoid any further entrainment of larvae at the CVP and SWP. On May 14 the Working Group recommended that the Delta hydrology be managed so that further entrainment of delta smelt could be avoided. If implemented, this would require the Projects to modify flows to achieve a non-negative daily net flow (meaning daily net flow should not be southward) in OMR. The Working Group recommended this be implemented as soon as possible and continue until southern Delta water temperatures reach 25°C, the lethal temperature threshold observed in the laboratory.

The Working Group reviewed the results from the fifth CDFG 20-mm survey, which was conducted from May 7 through May 12 (Figure 4a). The survey collected 8 larvae resulting in a total of 25 larvae so far this year. This was the lowest number of larvae ever collected, representing about 7.7 percent of the 326 taken to this point in 2006, and only 7.1% of the 2000-2006 average of 353. The fifth 20-mm survey also showed that larval delta smelt had moved into the central Delta, putting them at additional risk of entrainment.

On May 15, the Working Group presented a briefing statement to WOMT regarding recommendations for spring actions to protect delta smelt. In this statement, the Working Group presented their goal of no further entrainment of larval or juvenile delta smelt at the CVP or SWP for WY2007, and recommendation to achieve this through management of non-negative daily net

flow for OMR. Additionally, the Working Group recognized the following uncertainties (see Attachment 1):

1. Water project operations are not the only forces driving down delta smelt numbers. It is uncertain whether reducing pumping will substantially increase the percentage of this year's recruit class that survives to reproduce next winter.
2. It may not be possible, given flows and constraints on Project pumping, to achieve a zero net flow in OMR.
3. Given that delta smelt densities appear to be near the lower limit at which the 20-mm Survey may reliably detect them, the ability to accurately assess distribution of delta smelt larvae and to evaluate the efficacy of the recommended action is likely to be very low.
4. There is no prescriptive recommendation regarding the HORB; however, it is possible that the HORB's influence on OMR flow may be significant. Removing the barrier is a potential management tool to achieve the Working Group's recommendation.

Larval/Juvenile Delta Smelt EWA Action #1: On May 15, WOMT directed that CVP and SWP pumping be reduced such that OMR flows are -1,200cfs or less and that the HORB gates be opened. This action continued until May 29.

Larval/Juvenile Delta Smelt EWA Action #2: In late May, CDFG requested that DWR cease pumping at the SWP facility to the maximum extent feasible. DWR responded by neither diverting nor exporting between June 1 and 9. CDFG also sent a letter requesting all local agricultural diverters in the Delta cease pumping until further notice and requesting that the Interagency Ecological Program suspend all non-essential scientific collections of delta smelt. WOMT directed that the CVP and SWP pumping be minimized such that OMR flows are positive (downstream). This action continued from May 30 to June 9.

In late May, the Working Group recommended that the Delta Cross Channel (DCC) gates be opened to reduce the entrainment risk for delta smelt based on a comparison of particle fates for nine injection points in the central and western Delta in two 31-day PTM simulations. In early June, the Working Group again forwarded this recommendation to WOMT, with the caveat that the positive effect on delta smelt from this action would likely be very small, if any.

On June 10, DWR began limited pumping of 400 cfs at their SWP facility without resuming diversions at CCF. Diversions resumed and export pumping was increased to 2,500 cfs on June 13.

Results of salvage monitoring, recent surveys, and PTM completed June 11, 2007 indicated that most juvenile delta smelt were outside the entrainment foot print, and that the Projects could increase export pumping to 2,500 cfs combined, with little likelihood of entrainment of delta smelt. The Working Group recommended that should any delta smelt be taken at the export facilities, Project operations should immediately be modified to achieve a net flow in OMR as close to zero as possible. This recommendation was emphasized again by the Working Group on June 18, following additional entrainment of delta smelt at the CVP and SWP on June 13 and 17 (Figure 5).

On June 18, the Working Group discussed the endpoint for operational changes at the CVP and SWP. It was noted, that since reaching the thermal maximum, Delta water temperatures have dropped below 25⁰C, which may have allowed some juveniles to persist. WY2007, with concern at a very high level, the Working Group believed that the delta smelt currently being salvaged could still be valuable to the population as a whole. Further, the Working Group noted that temperature was not the only criterion in the decision flow chart; juvenile delta smelt collected by the 20-mm Survey had not yet reached a mean length of 40 mm (an indicator of improved swimming ability). Considering this, the Working Group believed that exports should be curtailed in an attempt to achieve OMR flows of zero. After discussion of trends in salvage and Delta water temperature, the consensus from the Working Group was to adhere to the decision process outlined on June 8, but instead of recommending a five-day wait with no salvage, the recommendation to modify Project operations to achieve a net flow in OMR as close to zero as possible would expire if no further salvage occurred.

On June 20, the Service submitted a dissenting opinion to WOMT regarding the June 18 Working Group recommendations (Attachment 2). The Service's opinion was based on:

1. Temperatures in the South Delta reached 25⁰ on June 18 and possibly on June 15, and appeared to be approaching the lethal limit for delta smelt. The Service anticipated that any delta smelt remaining in the South Delta would not be able to survive for a period sufficiently long enough to move to the vicinity of the confluence of the Sacramento and San Joaquin Rivers.
2. No delta smelt had been caught in the Central or South Delta in the most recent IEP sampling efforts.
3. No delta smelt had been caught at the CVP since June 17, when an expanded 12 fish were caught. The next most recent salvage of smelt at the CVP's facility occurred on June 13, when an expanded 48 smelt were caught. No other smelt were salvaged at the CVP's facility during June, 2007, even though pumping increased in the second week of June.

4. Salvage at the CVP is a better indicator of the current presence of delta smelt in the adjacent South Delta waterways.
5. Delta smelt had been salvaged at the SWP facilities, but the numbers salvaged had dropped from 168 on June 17 to 90 on June 19, while pumping has increased from 495 cfs on June 17, to 840 cfs on June 19.
6. Even if diversions were reduced or halted, current inflow from the San Joaquin River into the South Delta would not be expected to result in a sufficiently high net positive outflow towards the confluence before any delta smelt present in that area succumb to high water temperatures.
7. Any potential upstream reservoir change in operation would take a minimum of several days to influence flows entering the South Delta; and such releases are expected to reduce water supply intended to protect listed salmonids in the San Joaquin River watershed later in the year.

Based on these conditions, the Service determined that reductions in diversions at the SWP and CVP as of June 20 would not provide a benefit to those delta smelt remaining in the South Delta.

On June 25, the Working Group discussed the discrepancy between salvage at the CVP and SWP. From June 10-24, the SWP had salvaged 567, while the CVP had salvaged 60 (Figure 5). The SWP was not opening the radial gates completely, taking water into CCF at a much lower instantaneous rate to minimize the impacts of radial gate operations, while the CVP had been at capacity since June 19. According to particle tracking modeling run earlier, the Working Group would have expected to see little or no salvage, given smelt distributions suggested by survey sampling results, as the Projects would not be taking much water from the Sacramento River. There was some speculation that the fish being entrained at the SWP had been pulled into the CCF prior to June 10. The Working Group could not come to consensus regarding the source of the recently entrained SWP delta smelt. The Working Group concluded by recommending operational actions to DWR that could be taken to support inferences on the origin of the salvaged delta smelt, including (Attachment 3):

1. Drawing a large volume of water into CCF on a high tide, allowing it to mix, and then releasing it back through the radial gates on a low tide, creating a flushing action. If delta smelt were released into Delta channels, they should be salvaged at the CVP.
2. Continue export pumping with the radial gates closed, drawing CCF down to dead pool to remove as many smelt as possible. Then resume normal radial gate operations and monitor salvage numbers and densities.

On July 2 and 6, the Working Group discussed the continued salvage of high numbers of delta smelt at the SWP. The recommendation to moderate

operations to achieve a net upstream flow in OMR no greater than -5,000 cfs was made.

On July 9, the Working Group reviewed results from the PTM data, recent salvage, Delta conditions, and monitoring results. The Working Group determined the risk of entrainment had abated and recommended the rescinding of the recommendation to moderate Project operations to achieve a net upstream (negative) flow in OMR no greater than 5,000 cfs.

On July 10, WOMT notified the SWP and CVP that they could resume normal operations and export levels.

A total of 2,669 juvenile delta smelt were salvaged at the SWP in April, May, and June.

Discussion

Reducing the uncertainty in the estimates of entrainment would require new field experiments to measure delta smelt mortality in Clifton Court Forebay and the efficiency of the louvers at the Skinner Fish Facility. Matt Nobriga (CBDA Science) has developed a draft conceptual model for Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) that is expected to undergo peer review and be available in early 2008.

Further Considerations

The Steering Committee for the Bay-Delta Conservation Plan (BDCP) is developing a Comprehensive Conservation Plan (CCP) for the Sacramento and San Joaquin Delta pursuant to a planning agreement that was executed on October 6, 2006. The BDCP planning area is the legal Delta. In the first half of 2007, the Steering Committee developed a list of ten conceptual conservation strategies, evaluated those strategies, and shortened that list to four Conservation Strategy Options (Options) in May 2007. The Steering Committee intends to select one of the four Options to be carried forward into a detailed CCP in WY2008.

The 1996 Sacramento-San Joaquin Delta Native Fishes Recovery Plan currently is in the process of revision. The 1996 Recovery Plan included eight fish species and their recovery and restoration criteria.

The EWA agencies plan to implement the December 14, 2007 court order regarding implementation of the CVP and SWP for 2008. A copy of the decision can be found at:

http://www.fws.gov/sacramento/es/documents/OCAP_Final_Interim_Relief_Court_Order_12-14-07.pdf

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Table 1. Summary of Summer Tow-Net and Fall Mid-Water Trawl survey indices for delta smelt for the post-decline period.

Year	Summer Tow-Net Survey Index	Fall Mid-Water Trawl Index	Recovery Index³
1983	2.9	132	17
1984	1.2	182	51
1985	0.9	110	29
1986	7.9	212	70
1987	1.4	280	72
1988	1.2	174	67
1989	2.2	366	76
1990	2.2	364	81
1991	2.0	689	171
1992	2.6	156	26
1993	8.2	1078	400
1994	13.0	102	19
1995	3.2	899	252
1996	11.1	127	28
1997	4.0	303	62
1998	3.3	420	169
1999	11.9	864	322
2000	8.0	756	265
2001	3.5	603	314
2002	4.7	139	33
2003	1.6	210	101
2004	2.9	74	25
2005	0.3	24	4
2006	0.4	41	21
2007	0.4		5
Median	4.0	332.44	107.2
Min.	0.3	4	4
Max.	62.5	1673	589

³ The Recovery Index is defined in the Delta Native Fishes Recovery Plan (USFWS, 1996) and is derived from a subset of station data from the Fall Mid-Water Trawl

Table 2. Environmental Water Account expenditures in water year 2007.

<i>Action</i>	<i>Dates</i>	<i>Facility</i>	<i>Amount in TAF</i>	<i>Species Benefited</i>
DCC Gate Open		CVP	0 ^a	Adult delta smelt
MOR Flow Target	Jan - March	SWP	80 ^b + 160	Adult delta smelt
Pre-VAMP Shoulder	April 1-21	SWP	7	San Joaquin River FR Chinook Delta smelt
VAMP	April 22-30	SWP	11	San Joaquin River FR Chinook
VAMP	May 1-22	SWP	29.7	San Joaquin River FR Chinook
DCC Gate Open	May 16-30	CVP	0 ^a	Delta smelt
Post-VAMP Shoulder	May 23-31	SWP	41.9	San Joaquin River FR Chinook Delta smelt
Post-VAMP Shoulder	May 23-31	CVP	38.8	San Joaquin River FR Chinook Delta smelt
HORB Gates Held Open	May 16-June 15	SWP	0 ^a	Delta smelt
Post-VAMP Shoulder	June	SWP	73.7	San Joaquin River FR Chinook Delta smelt
Post-VAMP Shoulder	June 1-15	CVP	57.9	San Joaquin River FR Chinook Delta smelt
Total for WY 2007			500	

^ano EWA assets were used

^b80TAF of EWA water stored in San Luis was used before the 160TAF was used to reduce pumping at Banks

Table 3. Summary of EWA expenditures for Water Years 2001-2006, in thousands of acre-feet.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
WY2001				69	69	65	29	49	9	290
Species benefited				Salmonids	Salmonids smelt					
WY2002	5 ^a	15 ^a		66			28	149	5	248
Species benefited	Salmonids	Salmonids		Salmonids smelt			Salmonids smelt	Salmonids smelt	Salmonids smelt	
WY2003	13 ^b		32	89			19	208		348
Species benefited	Salmonids		Salmonids	Salmonids smelt			Salmonids smelt	Salmonids smelt		
WY2004							13	111		124
Species benefited							Salmonids smelt	Salmonids smelt		
WY2005			4.2		44.3		121.9	134	34.7	339.1
Species benefited			Salmonids		Delta smelt		Delta smelt	Salmonids smelt	Salmonids smelt	
WY2006							3	55	91	149
Species benefited							Salmonids	Salmonids	Salmonids	

^arelease of PCWA purchase from Folsom Reservoir, timed for flow and temperature benefits

^bpower generation bypass at Folsom Dam

Table 4. Tabular summary of salvage of delta smelt at the State Water Project (SWP) and federal Central Valley Project (CVP) export facilities since the implementation of the Environmental Water Account.

Month	December	January	February	March	April	May	June	Totals
WY 2001 Combined Salvage ^a (Drier)	192	181	3870	3,772	520	13,170	2,418	26,124
WY 2002 Combined Salvage (Drier)	1,129	5,231	280	225	372	47,361	11,926	66,526
WY 2003 Combined Salvage (Drier/Wetter)	2,776	9,561	1,494	483	492	16,309	10,096	41,211
WY 2004 Combined Salvage (Drier)	126	4,594	1,161	2,177	276	5,749	6,392	20,475
WY 2005 Combined Salvage (Wetter)	0	1,647	371	0	0	547	1,181	3,746

Month	December	January	February	March	April	May	June	Totals
WY 2006 Combined Salvage (Wetter)	0	36	72	216	12	0	0	336
WY 2007 Combined Salvage (Dryer)	0	0	36	0	24	428	1,509	1,997

^a Salvage reported on USBR's Central Valley Operations website, www.mp.usbr.gov/cvo/html/fishrpt.html

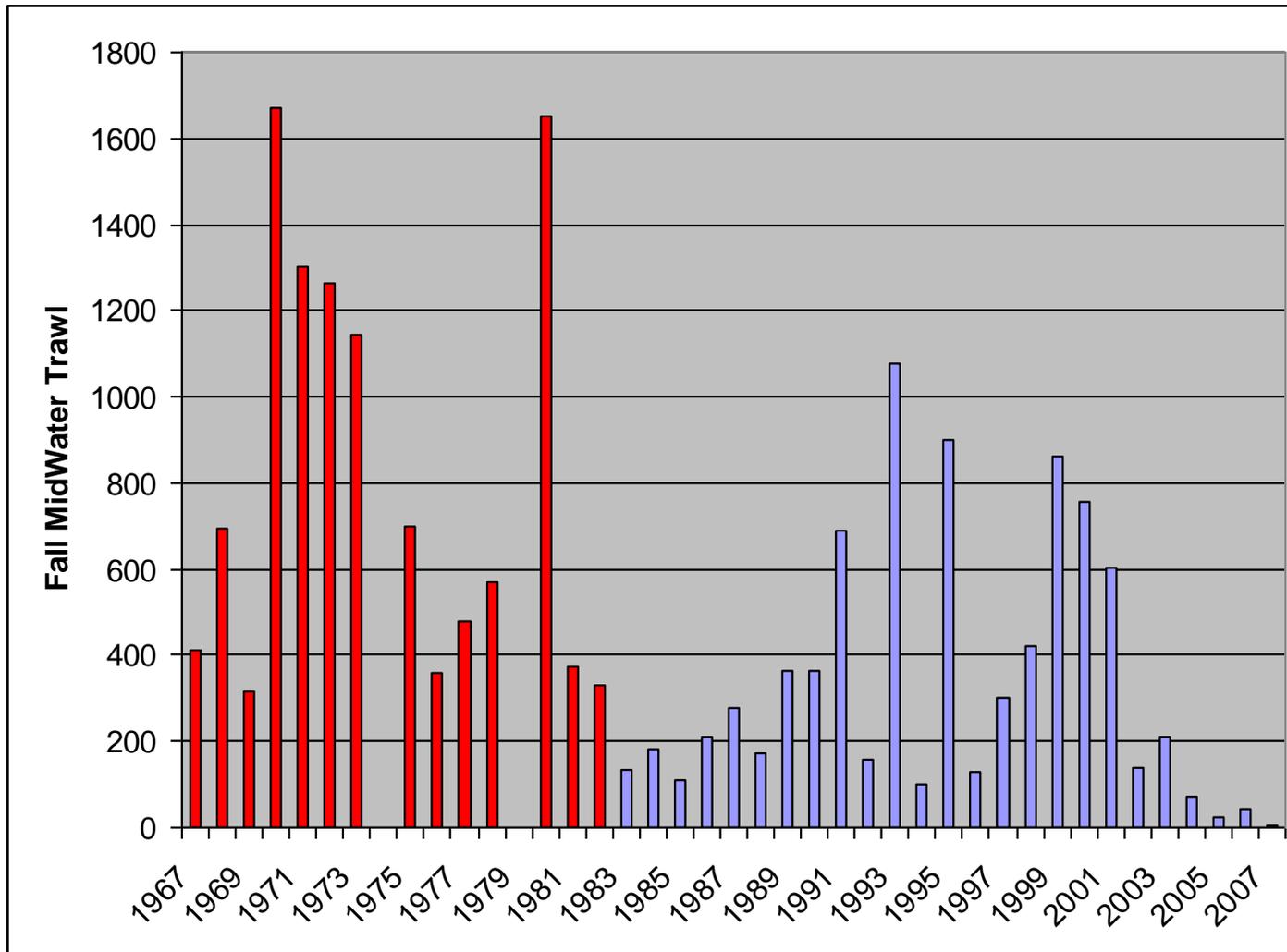


Figure 1. Delta smelt fall mid-water trawl index, 1967-2007.
 Post-decline years are in blue.

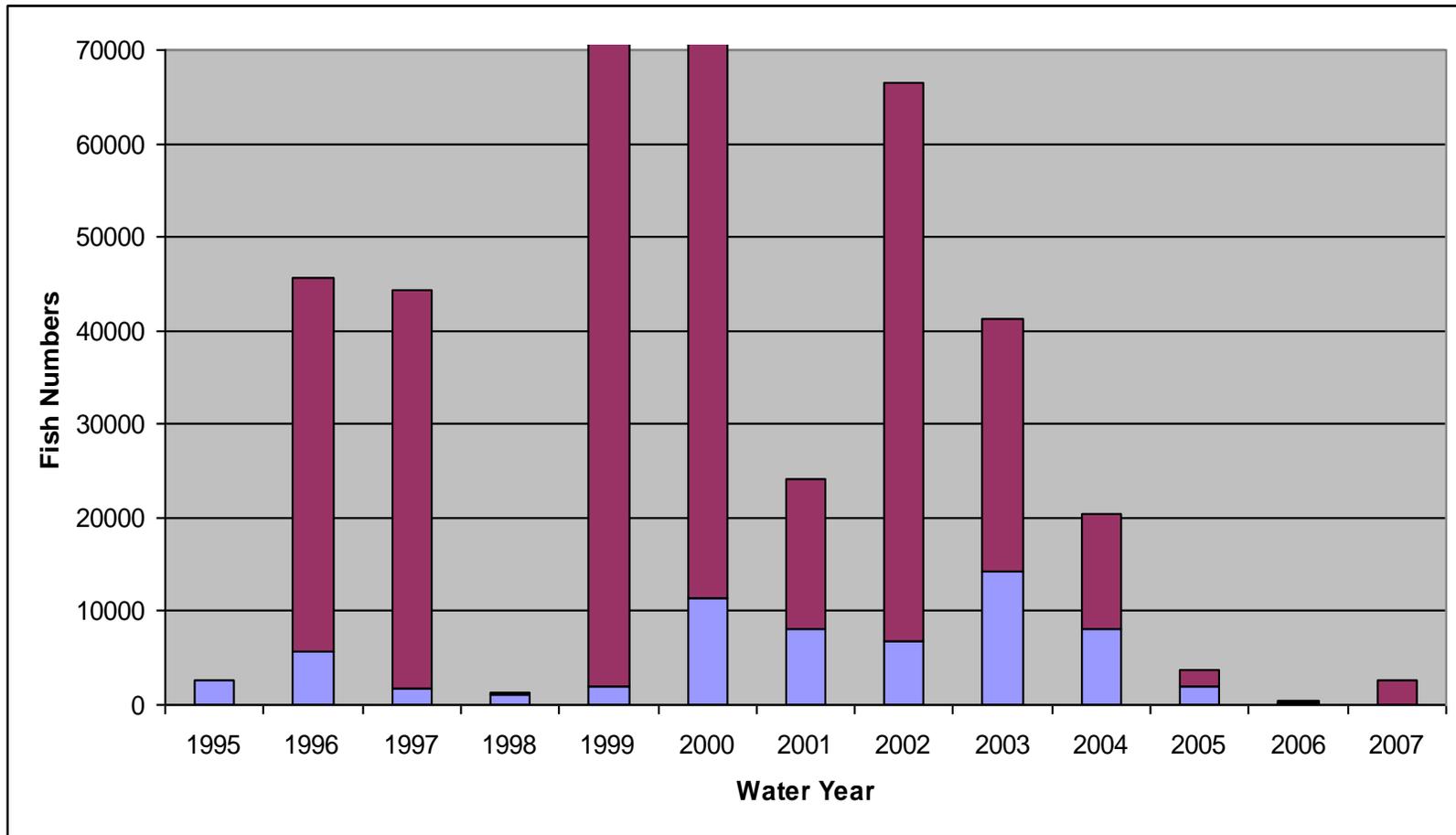
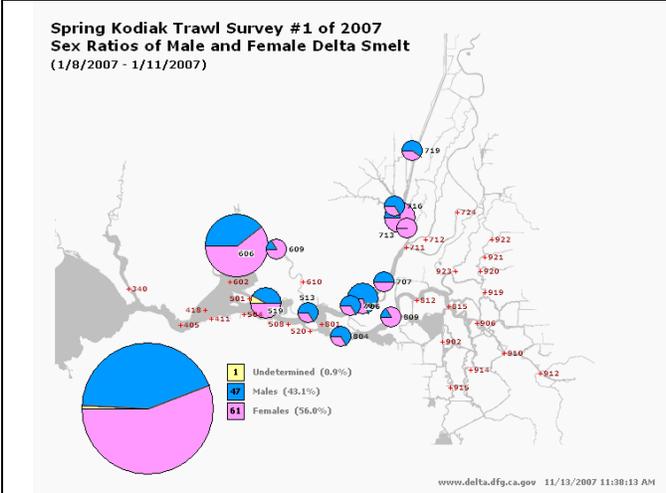
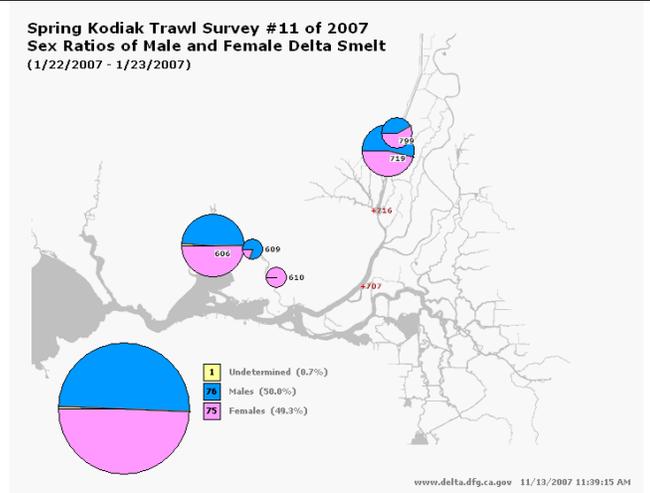


Figure 2. Salvage of delta smelt at the State and Federal export facilities for December through July, 1995-2007. The period of December 1 through March 31 is assumed to comprise mainly adult salvage, while the period of April 1 through July 31 is assumed to comprise mainly juvenile salvage.

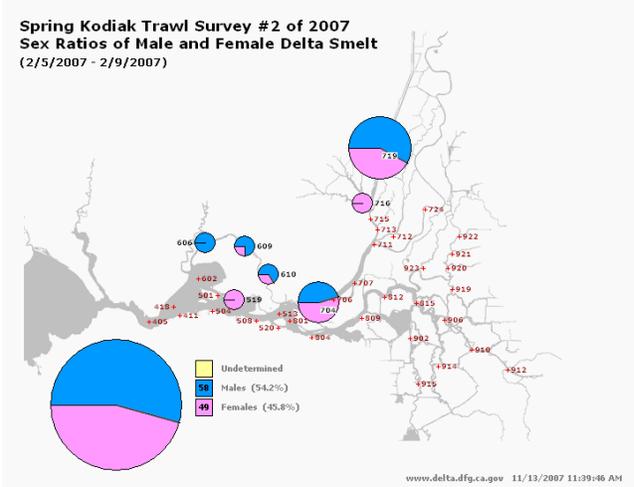
1999 salvage: 2,074 adults, 152,547 juveniles; 2000 salvage: 11,505 adults, 103,225 juveniles.



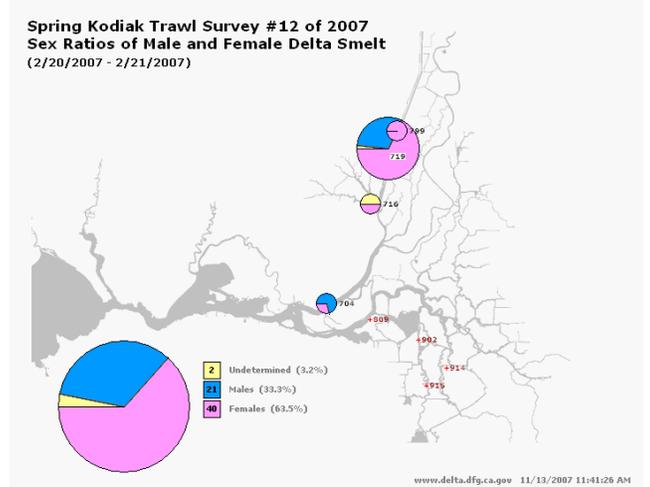
a.



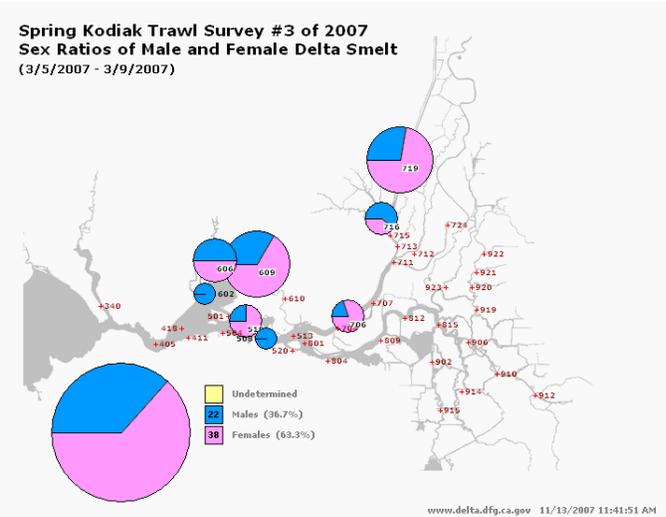
b.



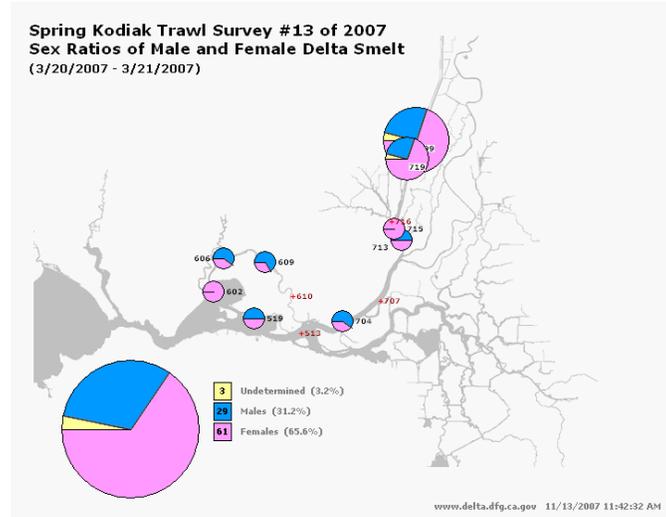
c.



d.



e.



f.

Figure 3a. Graphic representation of abundance and distribution of adult delta smelt in water year 2007 (January through March), as indicated by CDFG Kodiak Trawl Survey sampling.

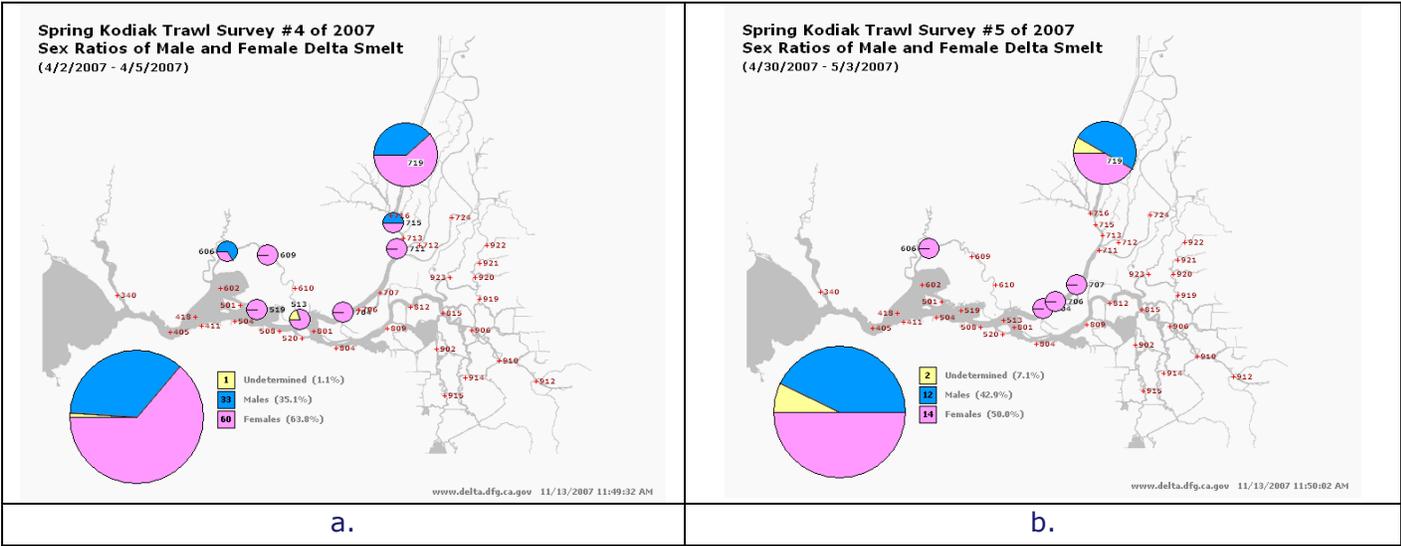


Figure 3b. Graphic representation of abundance and distribution of adult delta smelt in water year 2007 (April and May), as indicated by CDFG Kodiak Trawl Survey sampling.

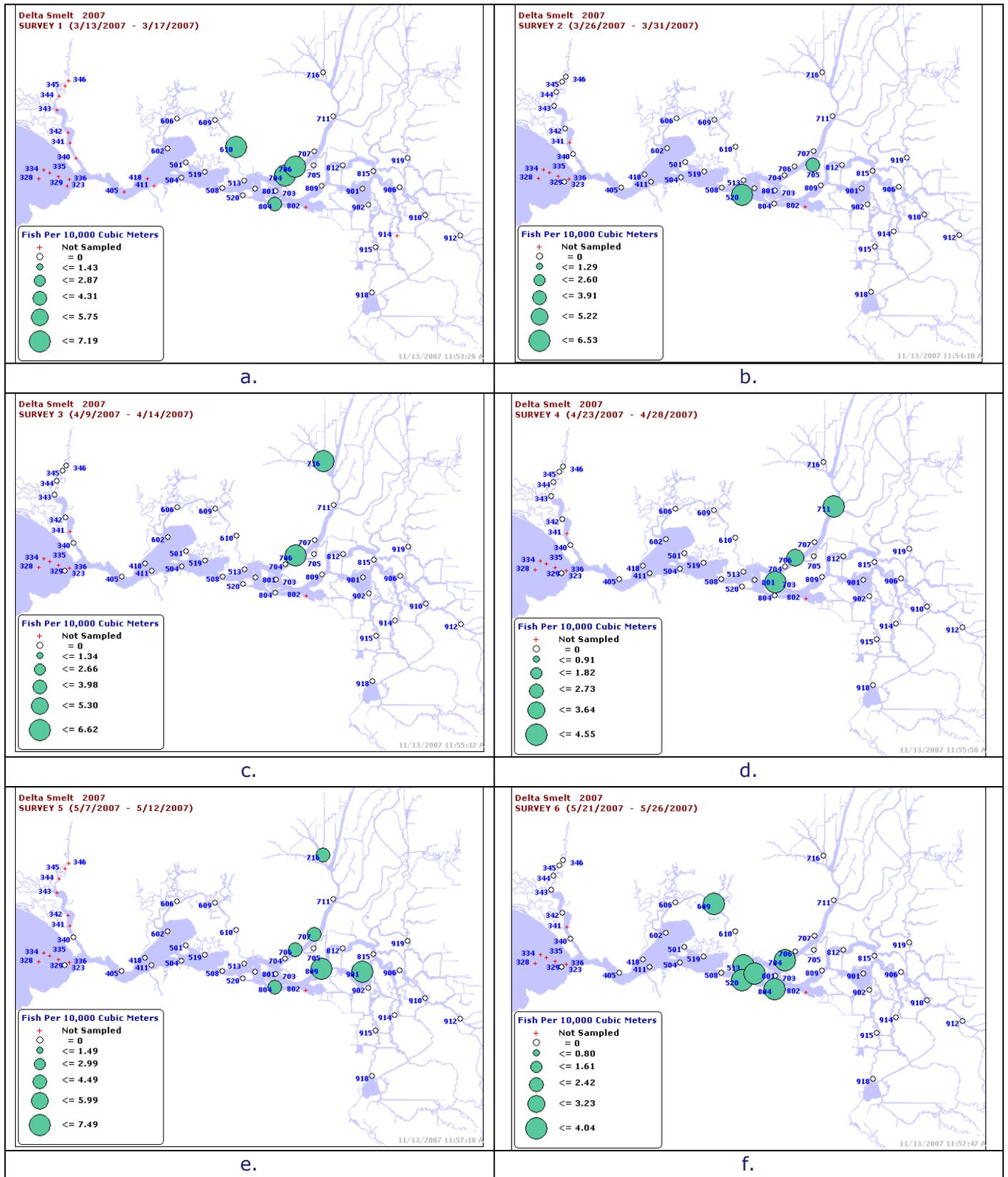


Figure 4a. Graphic representation of abundance and distribution of young-of-year delta smelt in water year 2007 (March through May), as indicated by CDFG 20-mm Survey sampling.

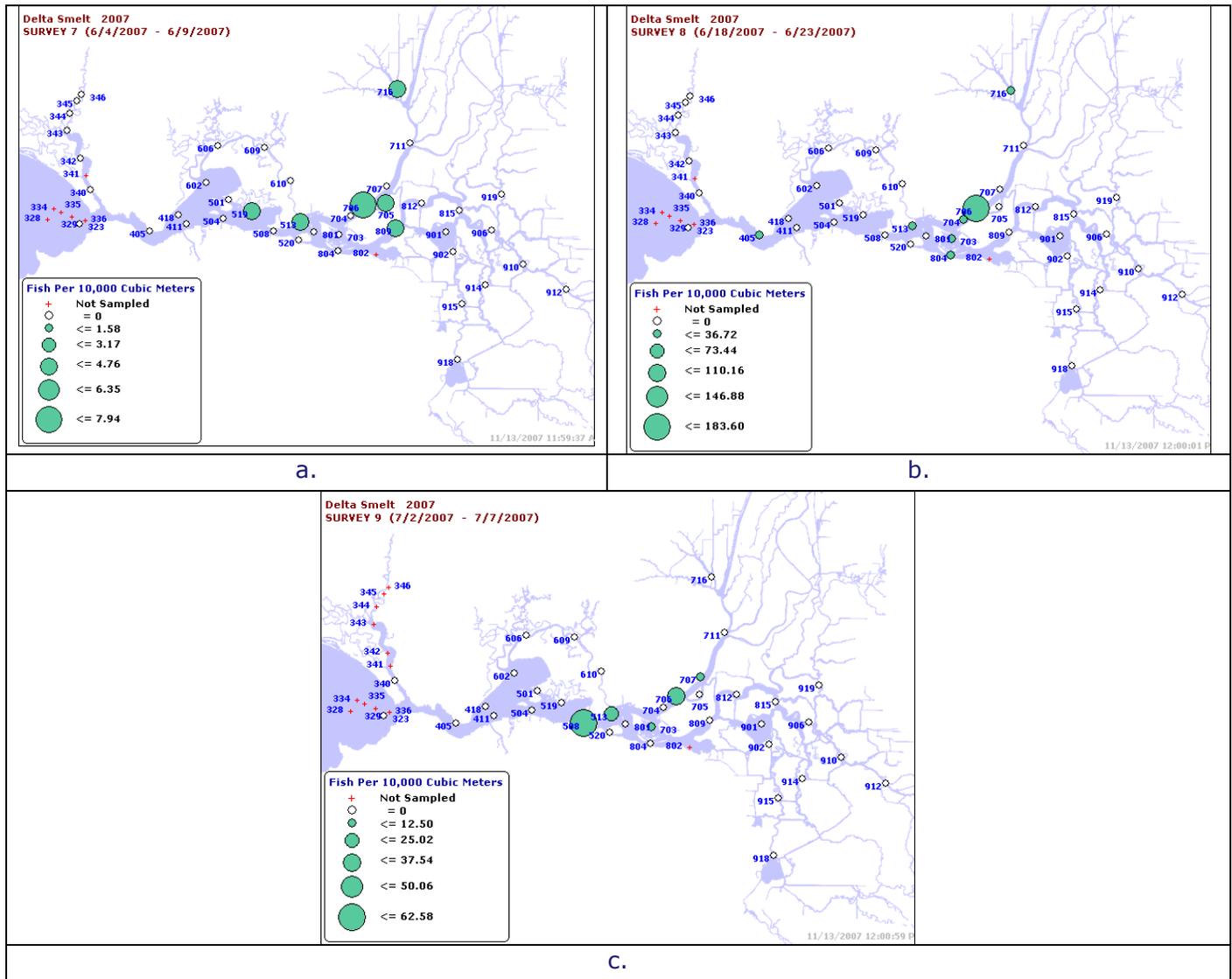


Figure 4b. Graphic representation of abundance and distribution of young-of-year delta smelt in water year 2007 (June and July), as indicated by CDFG 20-mm Survey sampling.

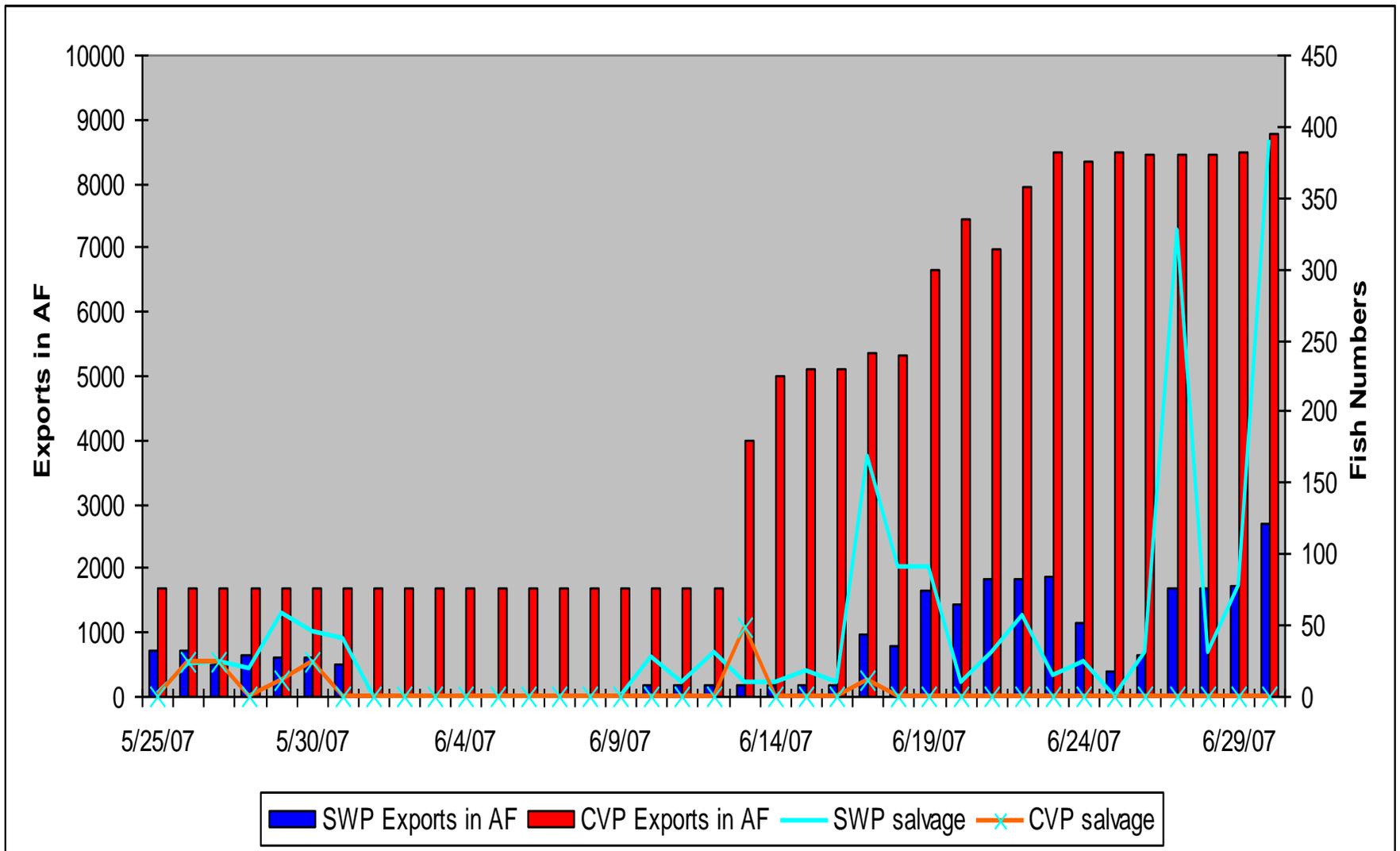


Figure 5: CVP and SWP exports and salvage of delta smelt from May 25 through June 30

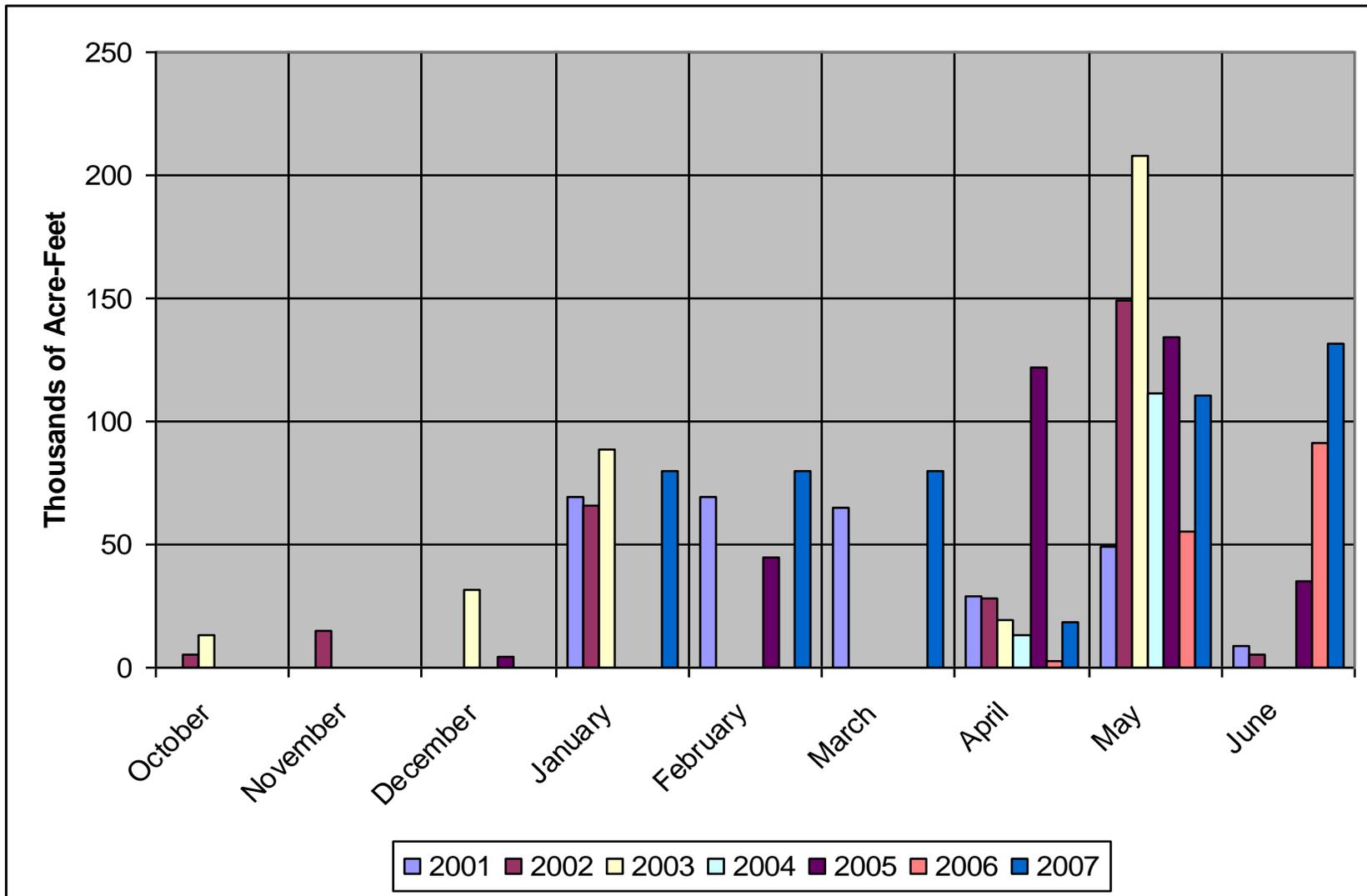


Figure 6: EWA assets expended annually, by month

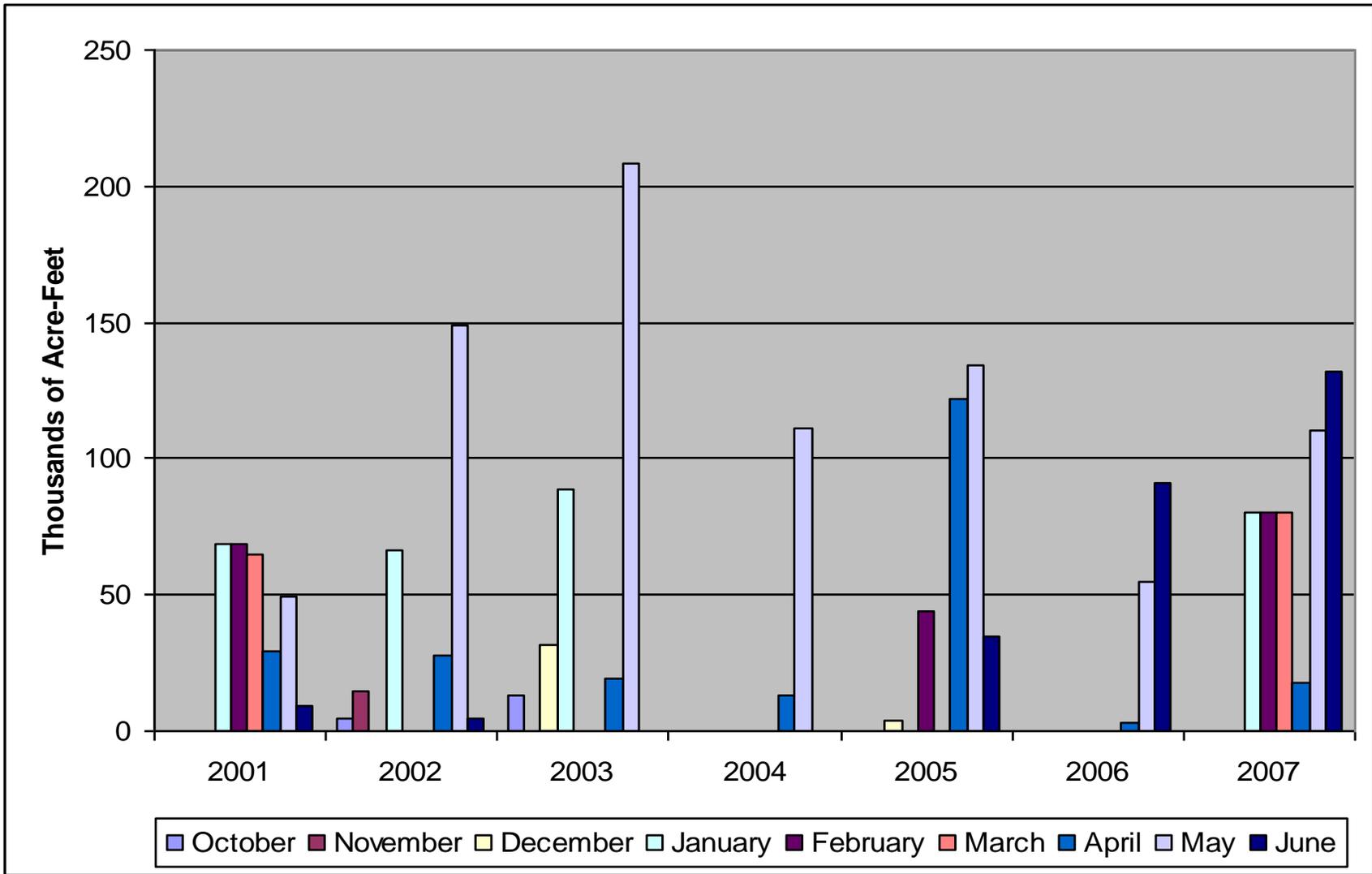


Figure 7: EWA assets expended monthly, by year

Attachment 1
(Briefing statement attachments not included)

Briefing Statement

From: Delta Smelt Working Group

To: Water Operations Management Team

Date: May 15, 2007

Re: Recommendations for Spring Action

Problem:

To date, the 2007 20-mm Survey for juvenile delta smelt has collected record low numbers of juvenile delta smelt. After the fifth of eight surveys, only 25 individuals have been collected, about 7.7 percent of the 326 taken to this point in 2006, and only 7.1% of the 2000-2006 average of 353. The DSWG has reviewed the progression of catches that typically occur during the course of the 20-mm Survey to evaluate the chance that there will be an upswing in the number of larvae collected later this year that will bring 2007 catches more in line with previous years. The group considers such an increase in catches to be possible but unlikely.

The likelihood of a very low outcome creates a very high degree of concern for the Delta Smelt Working Group. Water temperatures in the Delta have risen above the range wherein the majority of delta smelt spawning occurs, meaning that very little additional spawning is likely to take place this year. Further, the most recent 20-mm Survey results shows that delta smelt are distributed in the central Delta, increasing the risk of entrainment. In fact, the first salvage of delta smelt juveniles were observed at the Federal water export facility on May 11. For an annual species such as delta smelt, failure to recruit a new year-class is an urgent indicator that the species has become critically imperiled and an emergency response is warranted.

Recommendation:

The goal is no further entrainment of delta smelt. To achieve this, the Projects should modify flows to achieve a non-negative daily net flow (meaning daily net flow should not be southward) in Old and Middle River. This should be implemented as soon as possible and continue until southern Delta water temperatures reach 25⁰ C, the lab-lethal limit.

Uncertainties:

(1) The DSWG recognizes that water project operations are not the only forces driving down delta smelt numbers. Although we are confident the proposed action will reduce entrainment, it is uncertain whether it will substantially increase the percentage of this year's recruit class that survives to reproduce next winter. (2) The group also recognizes that it may not be possible, given flows and constraints on Project pumping, to achieve a zero net flow in Old and Middle River. (3) Given that delta smelt densities appear to be near the lower limit at which the 20-mm Survey may reliably detect them, our ability to accurately assess distribution of delta smelt larvae and to evaluate the efficacy of the recommended action is likely to be very low. (4) There is no prescriptive recommendation regarding the Head of Old River Barrier (HORB); however, it is possible that the HORB's influence on OMR flow may be significant. Removing the barrier may therefore be a possible management tool to achieve the Working Group's recommendation.

Management Implications:

The water cost of the recommended operational change is presently unknown, but may be significant.

Attachments:

1. Summary of Spring Kodiak Trawl survey for pre-spawning adult delta smelt
2. Summary of 20-mm Trawl survey for juvenile delta smelt
3. Frequency Distribution for 20-mm Survey
4. Frequency Distributions of Delta Smelt in the 20-mm Survey, 1995-2007
5. Frequency Distribution of Delta Smelt in the 20-mm Survey, 1995-2007. Equal scale on x-axis.

Attachment 2

Dissenting Opinion from the Delta Smelt Working Group's recommendation of 6/20/07

U.S. Fish and Wildlife Service biologists disagree with the Delta Smelt Working Group's (DSWG) recommendation from June 20, 2007. Currently, the temperatures in the South Delta are approaching the lethal limit for delta smelt, 25 degrees C, having reached that temperature on June 18, 2007, and possibly also on June 15, 2007. Because of these temperatures, the Service anticipates that any delta smelt remaining the South Delta will not be able to survive for a period sufficiently long enough to move to the vicinity of the confluence of the Sacramento and San Joaquin Rivers, where most smelt reside during the summer. Additionally, no delta smelt have been caught in the Central or South Delta in the recent IEP's sampling efforts. At the Central Valley Water Project (CVP) fish salvage facilities, delta smelt have not been caught since June 17, when an expanded 12 fish were caught. The next most recent salvage of smelt at the CVP's facility occurred on June 13, when an expanded 48 smelt were caught. No other smelt were salvaged at the CVP's facility during June, 2007. Over the past week, pumping at CVP has increased from 853 cfs on June 12 to 3,363 cfs on June 19. Since the CVP facilities do not a forebay in front of them, the salvage at the CVP is a better indicator of the current presence of delta smelt in the adjacent South Delta waterways¹. Delta smelt have been salvaged at the State Water Project (SWP) facilities, but the numbers salvaged have dropped from 168 on June 17 to 90 on June 19, while pumping has increased from 495 cfs on June 17, to 840 cfs on June 19. Even should diversions be reduced or halted, current inflow from the San Joaquin River into the South Delta would not be expected to result in a sufficiently high net positive outflow towards the confluence before any delta smelt present in that area succumb to high water temperatures. Any potential upstream reservoir reoperation would take a minimum of several days to influence flows entering the South Delta. Additionally, such releases are expected to reduce water supply intended to protect listed salmonids in the San Joaquin River watershed later in the year. Therefore, based on these conditions, the Service has determined that reductions in diversions at the SWP and CVP would not provide a benefit to those delta smelt remaining in the South Delta. It appears that few smelt remain in the South Delta and these fish are not likely to make it to the confluence area before temperatures reach 25 degrees C.

¹ Smelt salvaged at DWR's Skinner Fish Facility may have persisted for an indeterminate period in Clifton Court Forebay after having been entrained during diversions from the adjacent South Delta waterways

Attachment 3

Delta Smelt Working Group Meeting Notes

June 25, 2007

Participating: Julio Adib-Samii (CDFG), Gonzalo Castillo (USFWS), Mike Chotkowski (USBR), Kevin Fleming (CDFG), Fred Feyrer (CDWR), Erin Gleason (CDFG), Lenny Grimaldo (CDWR), Bruce Herbold (USEPA), Tracy Hinojosa (CDWR), Ann Lubas-Williams (USBR), Jim White (CDFG) and Victoria Poage (USFWS, convener and scribe)

For Discussion:

1. Update on current conditions and survey data
2. Discrepancy in salvage between CVP and SWP

Recommendation for WOMT: The Delta Smelt Working Group was not able to arrive at a consensus recommendation. Members of the Working Group will clarify their positions in writing for WOMT as soon as possible.

1. Fish and Game staff are in the process of sorting samples from survey 8 of the 20-mm Survey. Thus far they have collected no delta smelt at south or central Delta stations, and the total sample number is 53 (51 at station 706 near Decker Island and one each at stations 513 and 716). It seems likely that crews sampled a small school. This brings the grand total for the 2007 survey season to 90, still very low compared to other years. From 1995 through 2006, survey 8 collected an average of 134.9 delta smelt (range=42-218) and for surveys 1 through 8 collected an average of 1309.4 (range=587-3407). Survey 2 of the summer Tow-Net Survey began today; no data was available at the time of the call. Delta water temperatures are slowly warming; Clifton Court Forebay was at 24.2⁰ C yesterday (June 24) and the three-station Delta average was 23.3⁰ C. It is worth noting that DFG netted outside the CCF radial gates in 1994 at 25.6⁰ C and collected delta smelt.

3. Recent salvage of delta smelt is summarized in the following table:

Date	Exp. SWP Salvage	SWP Salvage Density	Exp. CVP Salvage	CVP Salvage Density	Combined Salvage	Cumulative Salvage	Daily Net OMR Flow
6/14/07	9	50.5618	0	0	9	620	-2623
6/15/07	18	94.24084	0	0	18	638	-2634
6/16/07	9	46.875	0	0	9	647	-2420
6/17/07	168	171.2538	12	2.24341	180	827	-2597
6/18/07	90	113.4931	0	0	90	917	-3509
6/19/07	90	54.02161	0	0	90	1007	-3510
6/20/07	9	6.329114	0	0	9	1016	-2138
6/21/07	30	16.23377	0	0	30	1046	-1895
6/22/07	57	30.77754	0	0	57	1103	-3360
6/23/07	15	8.004269	0	0	15	1118	
6/24/07	24	20.61856	0	0	24	1142	

There is a notable disparity between salvage at the State and Federal facilities, both in terms of numbers and in terms of density. The State is not opening the radial gates

completely, taking water into CCF at a much lower instantaneous rate to minimize the impacts of radial gate operations, while the CVP has been at capacity since June 19. Recent flows in Old and Middle Rivers have ranged approximately from -2000 cfs to -3500 cfs. According to particle tracking modeling run earlier, the Working Group would expect to see little or no salvage, given smelt distributions suggested by survey sampling results, as the Projects would not be taking much water from the Sacramento River. It is unlikely that the SWP is drawing water that is not accessible to the CVP; the three South Delta agricultural barriers are all operating tidally, a condition of which many on the Working Group were unaware, and requested that in the future, DWR keep them better informed of changes in barrier operations. There has been an overall declining trend in delta smelt densities at the SWP, which may be an indicator that recent salvage has consisted largely of fish resident in Clifton Court Forebay. Surface temperatures reached 26⁰ C in CCF, but the irregular bathymetry of the Forebay may create thermal refugia sufficient for juvenile delta smelt to survive, although probably not in large numbers. There are operations-related actions that could be taken by DWR to support inferences on the origin of the salvaged delta smelt, including:

1. drawing a large volume of water into CCF on a high tide, allowing it to mix, and then releasing it back through the radial gates on a low tide, creating a flushing action; if delta smelt were released into Delta channels, then they should be salvaged at the CVP
2. continue export pumping but with the radial gates closed, drawing CCF down to dead pool to remove as many smelt as possible, then resume normal radial gate operations and monitor salvage numbers and densities

Both of these potential activities may be problematic; they would very likely produce ambiguous results, and they may constitute violations of the SWP's diversion permit, and therefore not be workable. Both ideas were, however, submitted to DWR for further consideration.

During the course of discussion, the Working Group attempted to reach a consensus as to the meaning of the observed salvage, whether a recommendation was warranted, and what the recommendation, if any, might be. The Working Group was not able to achieve a consensus on any of these three points. Some believed that the salvage observed at the CVP was an indicator that delta smelt were not present in Delta channels, and that the present level of exports did not constitute a concern. Others believed that the uncertainty created by the disparity in salvage between the two Projects was sufficient cause for continued high concern. As consensus could not be reached, the various viewpoints must be written up and submitted individually as addenda to these notes.

Next meeting: July 2, 2007 at 3:00 pm, via conference call

Submitted,

VLP